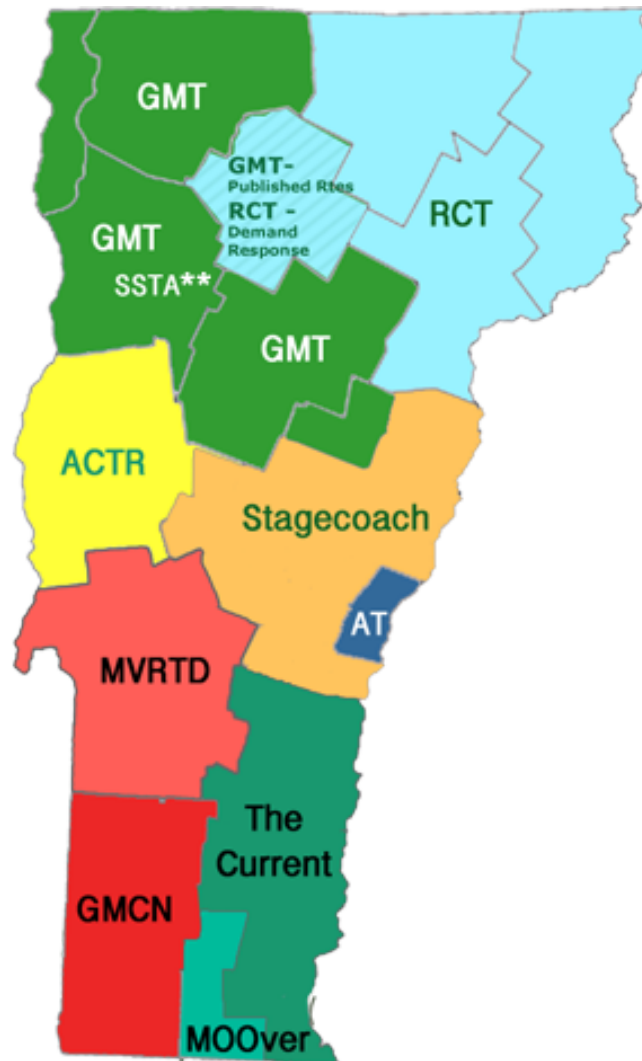


# Conditions for Successful and Innovative Transportation in Rural Vermont

Final Report of the Innovative Transportation Working Group  
Of the Middlebury College Senior Seminar in Environmental Studies



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## **Table of Contents**

Executive Summary.....	1
List of Acronyms.....	3
Introduction.....	5
Research Methods.....	8
Findings.....	10
Case 1: Ludlow.....	12
Case 2: Richmond.....	15
Case 3: Addison County.....	18
Case 4: State of Vermont.....	20
Conclusion.....	22
Future Considerations.....	24
Bibliography.....	31
Appendix.....	32
Matrices for Each Case Study.....	See attached figures.

### **List of Acronyms**

ACTR: Addison County Transit Resources  
ADA: Americans with Disabilities Act  
CCRPC: Chittenden County Regional Planning Commission  
CEP: Vermont's Comprehensive Energy Plan  
CTAA: Community Transportation Association of America  
GMCEITTF: Greater Middlebury Climate Economy Initiative Transportation Task Force  
(also cited as TTF or Task Force)  
GMT: Green Mountain Transit  
LMT: Ludlow Municipal Transit  
MVRTD: Marble Valley Regional Transportation District  
NEMT: Non-Emergency Transportation  
RPC: Regional Planning Commission  
SOV: Single Occupancy Vehicle  
T4VT: Transportation for Vermonters Coalition  
VMT: Vehicle Miles Traveled  
VNRC: Vermont Natural Resources Council  
VTEN: Vermont Transportation Efficiency Network  
WCRPC: Windsor County Regional Planning Commission

## **Executive Summary**

As transportation sits at the nexus of social and environmental issues, transportation innovation presents a unique opportunity to address issues of justice, environment, health, and power. Examining the context within which innovative transportation solutions can thrive helped us uncover many of the complexities within which the transportation system finds itself entrenched. Public transportation is an intensely contested and perpetually underappreciated service, limited perhaps most immediately by infrastructure capacity and effective legislation addressing comprehensive potential needs. Furthermore, public transportation requires the balancing of federal and state budgets with the changing needs of citizens.

As a mostly rural state, Vermont faces unique structural and cultural challenges in providing economically and environmentally efficient transportation throughout isolated areas with limited connectivity. With an eye to these constraints (which are discussed in more detail below), we set out to identify potential improvements to accessibility, sustainability, and efficiency across Vermont's rural transportation networks. With guidance from our community partners, the Transportation for Vermonters Coalition, we address the diverse interests of stakeholders who provide essential transportation services and represent the needs of rural communities by identifying both barriers and catalysts to improvement and by exploring innovative methods of transportation planning and strategy.

For this project, we chose to structure our definition of a successful transportation system around the principles of equity, access, and sustainability. It goes without saying that even the most

innovative and wide-reaching systems will have imperfections and gaps in service. Regardless, it is important to encourage and protect transportation systems that maximize equitable, accessible, and sustainable transportation services. With these qualities in mind, we set out to understand the preconditions that make successful innovation within a transportation system possible and sustainable. Unable to determine an objective set of ‘conditions for success’ in transportation system, we instead looked to understand the conditions (real barriers, catalysts) that contributed to successful transportation systems. We began by looking for existing transportation systems that modeled the attributes we wanted and reflected the interests of our partner groups.

We analyzed situational factors that could be beneficial or detrimental depending on the community in question and incorporated the principles we found fundamental to each situation into a generalized framework of rural transportation systems. This framework consists of nine categories encompassing social conditions and factors at three scales: 1) the level of individual communities (local) to 2) interconnected areas (regional) to 3) a state-wide level of analysis. Many of the categories are overlapping, but each one allows for distinct evaluation of certain conditions of the transportation system at all three scales.

The categories are as follows: (1) stakeholders, (2) governance, (3) communication, (4) funding, (5) legislation, (6) infrastructure, (7) connectivity & mobility, (8) distribution of access, and (9) culture & perceptions. This framework--what we term a *matrix of rural transportation*--is meant to function as an evaluative tool for an individual rural community, where knowledgeable individuals can identify the major factors influencing transportation to conceptualize how these factors scale across different levels of community and to strategize what might encourage or restrict the success of improvements to the community’s transportation system.

## **Introduction**

Some of the barriers to innovating in the transportation sector originate in antiquated legislation originally designed to promote the use of the automobile as the primary method of mobility. Federal policies for transportation funding established in the 1950s under President Eisenhower still provide the vast majority of public funds to highways and infrastructure used mostly for single-occupancy vehicles. Public transportation receives a small fraction of these funds (Bogren 2018). Furthermore, decreased gas tax revenues from greater fuel efficiency have diminished a central source of funding for public transportation (Pew 2015). This occurs despite strong trends that driving is on the decline and public transportation on the rise. For example between 2005 and 2011, Americans increased public transportation trips by 10% or 900 million rides. Although per-capita vehicle miles traveled decreased between 2007 and 2013, a growing population means that total vehicle miles traveled is still rising and increasingly stresses the capacity of our transportation system, demanding improvements in public transportation.

Vermont's rural nature means that residents drive more than the average US citizen, but there is still strong, albeit disperse, demand for public transportation. Participants in 2015 Vermont Transportation Board forums clearly expressed a desire for improved public transportation, and expressed that they would ride public transportation if it met their needs and schedule (Vermont Transportation Board 2015, pp. 10-20)

Public transportation serves many of Vermont's rural and isolated areas, but connectivity remains an issue, especially because the majority of population growth since the mid-twentieth century has occurred not in traditional population centers but in outlying and new growth towns (Vermont Forum on Sprawl 1999).

Other demographic and legislative factors have only compounded these difficulties. With the recent passage of Act 46, the mandated consolidation of Vermont's school districts has disrupted

transportation patterns and put additional capacity strains on school buses and after-school shuttles (Pache 2015). The opioid epidemic increasingly strains capacity of paratransit programs like Addison County Transit Resource's (ACTR) Dial-a-Ride, as these non-emergency medical transportation services are mandated and funded by Medicaid for both transit to medical care and prescription pick-ups for those who do not have other modes of transportation. This drug crisis is especially difficult in rural areas with slower emergency medical service response times and longer transit to medical services, further emphasizing the importance of this service to routine medical help (National Rural Health Association, 2017).

In the face of these compounding trends, **it is necessary to look for ways to encourage more efficient, accessible, and sustainable methods of public transportation.** Our partners for this work are the Middlebury Climate Economy Initiative Transportation Task Force (henceforth Task Force) and the Transportation Coalition for Vermonters (T4VT). Both T4VT and the Task Force are concerned with making Vermont transportation more sustainable and accessible. The agendas of these organizations are tailored to meet the interests of their member organizations and the communities they represent; thus, both groups are fully committed to the general principles of improved transportation as set forth in this project.

T4VT represents a wide range of interests across the state including the American Association for Retired People, the Sierra Club, and the American Lung Association. The coalition is coordinated by the Vermont Natural Resources Council to represent the interests of all its members and participants. Its main functions are to advocate for statewide policies that improve the sustainability and accessibility of Vermont's transportation systems and to educate members of the community about the importance of sustainable and accessible transportation in rural states like Vermont. **For this project, we sought to provide T4VT with a framework of conditions for**

**successful innovative transportation systems and case studies illustrating how a variety of transportation methods can be successful across communities.**

The Transportation Task Force was formed to conduct a holistic review of the transportation system in and around the town of Middlebury. The Task Force hopes to improve transportation in the Middlebury area in a variety of ways, but our research goals coincided with the Task Force's interest in coordinating Bet-Cha, a private school bus company that serves the public schools in the Middlebury area, with ACTR, the Addison County public transportation service. **For this project, we worked to identify potential barriers preventing coordination between private and public transportation services in Addison County as well as provide the Task Force with informed strategies for improving the efficiency of transportation services throughout the county.**



## **Research Methods**

This project examined the conditions of success in transportation systems in the state of Vermont across four scales of size and scope. We began with in-depth *textual analysis* of regional planning reports and transportation studies, built upon our initial research by implementing *chain referral sampling* to identify key areas of research, and utilized *semi-structured interviews* to understand the complicated dynamics of individual case studies and the broader issues facing rural transportation systems. Initial goals of this project included analysis of case studies from which to construct a model for an innovative transportation model. By working through our case studies, we identified the interdependent, complex set of conditions that contribute to the success (or lack thereof) of innovative transportation models. We plan for the matrix to be a tool that future planners use to organize and comprehend the specific nature of their own case study.

Research in this stage consisted of semi-structured interviews with members of transit organizations and groups in the municipalities of Ludlow and Richmond. Textual analysis and semi-structured interviews with transportation scholars Scott Bogren of the CTAA and Todd Litman of the Victoria Transport Policy Institute led to the process of building a framework in which a transportation system operates. Our continued research into the varying levels of our project led us to construct a *matrix of rural transportation*, a tool which rural communities can utilize to evaluate their transportation system.

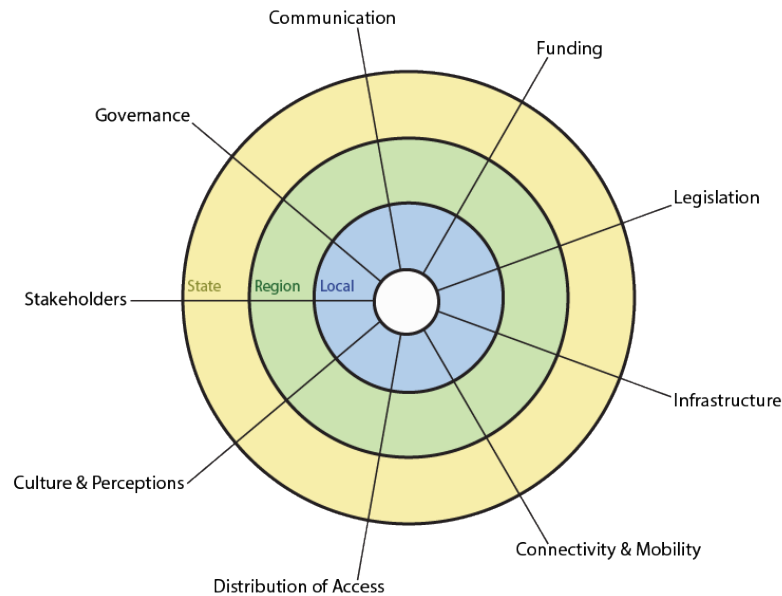
The framework provided by the rural matrix addresses nine components of the transportation framework observed in Vermont case studies (as shown in Figure 1). Of course, not every category will be pertinent to each community's transportation system. The rural matrix is meant to be flexible and adaptable to the specific conditions of each community.

We created three accompanying questions for each category to refine the scope of the framework and to define the unique situational circumstances of each community (see Appendix).

The first question is an objective “surface-level question” that identifies *logistics* of the system, such as key stakeholders, funding, etc. The second question prompts discussion of *normative practices* that may not be explicitly identified by the community, such as cultural attitudes toward transportation, access to transportation options, and distribution of funds. The community, having identified the framework through the two prior questions, then answers the final “goal-oriented” question designed to contribute to *transformative* transportation planning. This matrix is not designed to offer pre-packaged solutions for each community. Textual analysis and semi-structured interviews revealed the specificity of each transportation system; we designed the rural matrix to elicit communal examination of each communities own unique circumstances that determine the transportation system most appropriate for its needs.

## Findings

Our research into successful cases of innovative transportation presented a wide array of explanations regarding the mechanisms and conditions for success in each case. From our interviews with rural transportation scholars and planners, we found that many of the conditions allowing for innovative transportation in Vermont share similarities with the transportation dynamics of rural communities across the country. One interview subject in particular suggested we compile the multifaceted and overlapping conditions contributing to innovative rural transportation in a single, interconnected network of socio-environmental and socio-political factors (Litman 2018). The framework we used to organize our findings culminated with a *matrix of rural transportation*, in which we organized pertinent factors relevant to the transportation systems of rural communities at local, regional, and state levels. This is shown below in Figure 1.



**Figure 1.** Matrix of rural transportation.

The rural matrix serves as a template of general factors contributing to and restricting rural transportation systems at nested scales of size. It functions as an *evaluative* tool for rural communities seeking to analyze and improve their transportation services. We chose to focus the structure of the matrix on community transportation systems rather than on a singular mode of transportation service. This is in large part due to the fact that rural transportation is not a ‘one size fits all’ issue -- in fact, even the most successful rural transportation systems have inefficiencies and limitations to funding and/or capacity. A successful transportation system should come more from a set of conditions rooted in the community in itself -- the users, operators, and advocates for transportation services -- than from any pre-established or formulaic system alone. Research shows that no matter how innovative, efficient, or sustainable a certain transportation technology or system may be, its success ultimately depends on the circumstances under which it is implemented and which members of the community are allowed to access it.

In the following section, the template of the *matrix of rural transportation* is applied to four case studies, to both display how transportation issues are nested into broader systems and to determine the conditions of success for these communities.

### **Case 1: Ludlow**

We utilize Ludlow as a “small-town” case study due to a population of roughly 2,000 residents. However, Ludlow possesses several characteristics that differentiate it from Vermont towns of a similar size. The Okemo Mountain Resort draws a large amount of wealth through recreation and non-residential landowners; the total assessed value of all valuable taxable property possessed by Ludlow residents is \$1.6 billion dollars (VTEN, 2016). Although the majority of this property belongs to non-residents utilizing their land for vacation purposes, the property taxes nonetheless results in a town budget magnitudes larger than other small Vermont towns.

Ironically, a lack of funds prompted Ludlow’s transportation shift. The Equal Educational Opportunity Act of 1997, commonly referred to as Act 60, mandated that every town’s tax revenue went into a statewide fund (VTEN, 2016). The state, having determined the education spending per Vermont pupil, distributed money to each school based on its total need, i.e. the number of students (F. Heald, personal communication, April 12, 2018). While this oversimplification ignores the more nuanced aspects of Act 60 and its subsequent amendments, the distribution of money from the wealthy towns to those less wealthy created significant problems in Ludlow. Suddenly, Ludlow did not have enough money to maintain its school bus routes in its new allotted education budget.

As previously stated, Ludlow converted its school bus system to include a new public transportation model. A new organization, Ludlow Municipal Transit (LMT), was formed to complete this transition (F. Heald, personal communication, April 12, 2018). LMT purchased the school buses from the school board, painted them a federally-mandated green color, and began using these buses for public transportation that transported both students and the broader public (VTEN, 2016).

There were several key conditions in Ludlow that allowed this to occur. First, the school board of Ludlow owned the buses (VTEN, 2016). If the school system used a private company for

transportation, the federal Urban Mass Transportation Act would prevent Ludlow from forming a public transportation system that directly competes with a private company for ridership (F. Heald, personal communication, April 12, 2018). While the Marble Valley Regional Transit District (MVRTD) offered a fixed-route bus service to numerous other towns from Ludlow, LMT's new transportation system would fulfill the hub-and-spoke transportation needs not met by MVRTD. Secondly, Ludlow is wealthy enough to purchase these buses, modify them, and sustain a public transportation system. The \$250,000 LMT annual budget comes from property taxes. Although the school board gave \$5,000 dollars annually to LMT, this contribution is not essential to maintain operations. Consequently, LMT is able to offer fare-free services; Ludlow regards transportation as a public good that users should not pay for beyond their property tax (F. Heald, personal communication, April 12, 2018).

However, aspects of the Ludlow model place the accessibility of this "public good" at risk. Due to Ludlow's sole reliance on their town budget, their transportation system does not to adhere to state or federal accessibility requirements (VTEN, 2016). Therefore, two of Ludlow's six vehicles do not possess wheelchair lifts. Individuals interviewed concerning the Ludlow model acknowledged the importance of providing accessible transportation to all individuals, yet this model illustrates the possibility of independently funded transportation systems only offering service to select members of the population (F. Heald, personal communication, April 12, 2018). On a practical note, these vehicles prohibit the use of federal funds that may become necessary for LMT's public transportation. This situation may also promote broader inequity via a culture of inaccessibility, i.e. disabled individuals are unable to use public transportation to acquire jobs, further increasing inequality for those individuals. Despite this, the Ludlow model appears to offer sufficient accessibility to its users due to its small-town size.

The size of Ludlow is another key factor in this model's success. Ludlow Municipal Transit uses its buses to essentially fulfill the same role as school buses; transportation workers in Ludlow estimate that 90% of those riding the bus are students (F. Heald, personal communication, April 12, 2018). Students in other Vermont towns, such as Weybridge, may ride the private school bus system for an hour each morning because of the town's decentralized, sprawling population (F. Putnam, personal communication, March 19, 2018). Comparatively, Ludlow students rarely ride the LMT buses for more than half an hour.

Furthermore, public transportation for non-students in Ludlow largely consists of the Okemo Mountain Resort shuttle and the Marble Valley Regional Transit District (based in Rutland, Vermont) routes to other towns, such as Rutland (F. Heald, personal communication, April 12, 2018). This limits the scope of public transportation that LMT is responsible for to a scale that the town of Ludlow can support in a comfortable and relatively accessible manner. If the demand for ADA accessible vehicles, expanded routes, or increased number of buses grew, Ludlow Municipal Transport may experience financial and logistical complications.

For our *matrix of rural transportation* filled in according to the characteristics of the town of Ludlow, please see Figure 2 in the attached pages at the end of the report.

### **Case 2: Richmond**

We classify Richmond as a mid-size town due to its population of 4,081. Richmond is located 12 miles from Burlington, the largest city in Vermont, and 30 miles from Montpelier, the state capital. Many individuals living in Richmond commute to either location for work (I. Stokes, personal communication, March 19, 2018). This commute occurs on either U.S. Highway 2 or 89, both of which pass directly through Richmond's town center. Due to the high number of single occupant vehicles (SOV) commuting, the state government constructed a park and ride on Highway 2 in the 1980s (E. Churchill & P. Keating, personal communication, April 25, 2018).

Around the year 2000, the Green Mountain Transit (GMT) LINK bus carrying passengers between Montpelier and Burlington began stopping at the park and ride (I. Stokes, personal communication, April 17, 2018). While the primary use of the park and ride prior to the LINK bus was ride-sharing amongst personal vehicles, a growing percentage of users utilized the LINK bus to commute (E. Churchill & P. Keating, personal communication, April 25, 2018).

Future alterations to the park and ride prioritized this shift in use, such as the mid 2000s restructuring that allowed the bus to easily pull in and out in a continuous loop (E. Churchill & P. Keating, personal communication, April 25, 2018). The majority of LINK bus routes operate in the peak AM and PM commuting times, i.e. before 8 AM and after 5 PM. Individuals walk, bike, or drive to the park and ride, leave their vehicle (if they used one) at the park and ride, and board the LINK bus.

Richmond's facility is the most heavily used park and ride in Vermont and frequently cannot accommodate all users with its constrained space. Members of the Richmond Trails Committee are taking an active role in making the case for expanding the parking spaces at the Richmond park and ride and they are also pursuing other transportation options to relieve pressure off their overcrowded park and ride (E. Churchill & P. Keating, personal communication, April 25, 2018; I. Stokes, personal communication, March 19, 2018). The Chittenden County Regional Planning Commission (CCRPC) is aware of the demand for Park and Ride facilities in this region and is currently constructing a park and ride in nearby Williston to relieve pressure on Richmond (E. Churchill & P. Keating, personal communication, April 25, 2018).

An informational graphic at the Richmond park and ride details ridesharing, i.e. transporting multiple people in a personal vehicle instead of one driver (I. Stokes, personal communication, March 19, 2018). And, the Richmond Trail Committee has developed an extensive trail system in



and around Richmond for walking, running, and biking (I. Stokes, personal communication, March 19, 2018). The active efforts of this committee appear to significantly contribute to a culture of using non-motorized travel when possible in Richmond.

However, Richmond's public transportation is not without its challenges. While Richmond's proximity to major employment centers appears to guarantee heavy use of their park and ride, the logistics of this system present challenges. The park and ride is located on Route 89, a busy highway with narrow shoulders for bikers. Consequently, a primary reason for the lack of sufficient parking space for the park and ride may be the necessity of driving to the facility (I. Stokes, personal communication, March 19, 2018).

Furthermore, the park and ride creates several noteworthy interactions between various players. Chittenden County Regional Planning Commission is primarily responsible for this park and ride (E. Churchill & P. Keating, personal communication, April 25, 2018). Consequently, like most of the park and rides on major Vermont highways, "Richmond's" park and ride is actually owned and maintained by the county commission (E. Churchill & P. Keating, personal communication, April 25, 2018).

When CCRPC first proposed expanding parking space, the town of Richmond offered significant resistance (E. Churchill & P. Keating, personal communication, April 25, 2018). The town did not wish to become the main park and ride facility in Chittenden County and desired for other viable communities to "share the responsibility of having a park and ride." (E. Churchill & P. Keating, personal communication, April 25, 2018) This "responsibility" is largely related to a decreased perception of safety as a result of increased traffic levels; the state pays for the vast majority of upkeep so there is not a local cost burden.

The park and ride draws users from outlying communities as it is not located in the center of town. It is unknown if the park and ride provides a significant increase in commerce or otherwise

benefits Richmond; the main effect of the facility may be to increase traffic without addressing subsequent decreases in safety for other modes of transportation. Also, Richmond's geographical location poses challenges. The park and ride borders the Winooski River and consequently experiences routine flooding (I. Stokes, personal communication, March 19, 2018). Mountains surround Richmond and renders bicycle commuting impractical transportation for individuals living in the rural sprawl (I. Stokes, personal communication, March 19, 2018). While the park and ride fulfills the commuter goal between Richmond and larger metropolitan areas, its challenges reveal the importance of holistic cross-jurisdictional planning.

For our *matrix of rural transportation* filled in according to the characteristics of the town of Richmond, please see Figure 3 in the attached pages at the end of the report.

### **Case 3: Addison County**

Addison County (specifically its regional transit provider ACTR) proved to be a story of quantifiable success. For the past nearly 15 years, the organization operated at a surplus (maintained stability while growing), merged with another public transportation nonprofit to improve the health of that operation, quadrupled ridership, and improved route efficiency by redistributing routes. ACTR, committed to careful planning and community engagement, also took feedback into account in its decision-making processes (N. Barnicle, personal communication, April 26, 2018). In response to ridership data and customer service data, ACTR restructured some of its routes to adapt to make stops and pick-up times more convenient, serving as a healthy example of robust communication and feedback between users and the service provider.

The county is significantly wealthier than other counties in Vermont and holds many significant resources for the state: medical resources at Porter Hospital (UVM Medical Center) and numerous education and employment opportunities at Middlebury College. While Addison County

contains significant population centers in which traditional hub-and-spoke or fixed route transportation systems work, these systems may not be flexible enough to accommodate all users as there are still many potential riders located in outlying areas within the county, pointing to the importance of ACTR's paratransit service.

ACTR merged with Stagecoach Transportation Services to form one transportation agency in January of 2014 ("ACTR and Stagecoach Merge," 2017). ACTR members saw this merger as an absorption of a struggling entity with the knowledge that ACTR could bolster the community health in the Stagecoach area and improve Stagecoach's service capability. In this instance, one model was able to replicate its own success by taking over operation in a different area.

ACTR has an impressive paratransit service setup, but its resources are strained by large numbers of Medicaid users and limited overall funding. The Department of Vermont Health Access (DVHA) funds non-emergency medical transportation for Medicaid recipients, meaning these individuals can obtain a ride to a medical service or appointment through a regional public transportation provider (in this case, ACTR) (Vermont Public Transportation Association, 2018). However, Medicaid funds trips per rider rather than per ride, so the cost of a paratransit service (if no fixed route is available for an individual) weighs on ACTR's budget (C. Loyer, GMT, personal communication, April 19, 2018). Funds are also only distributed for each rider, regardless of how many rides that rider utilizes. So when riders are consistently utilizing this service, the transportation provider (ACTR) bears most of the financial burden of these trips.

As Vermont finds itself challenged by the opioid epidemic, ACTR is left with both its capacity and budget strained to accommodate the large number of Medicaid clients utilizing the service. Sixty percent of transportation under Vermont's Medicaid contract is transport to opioid treatment facilities (Donovan, 2018). This strain on budget and capacity is the new dilemma ACTR finds itself trying to address. ACTR is not alone in this difficulty, as Green Mountain Transit faces

the same issue (C. Loyer, personal communication, April 19, 2018) as do all the rural transportation providers in Vermont. However, ACTR in particular is attempting to strengthen its highly utilized paratransit system (necessary because of the low geographic connectivity of the county) and trying to maintain and promote the use of its deviated fixed-route shuttle bus system, while balancing its budget and accommodating the needs of its Medicaid clients at the same time.

For our *matrix of rural transportation* filled in according to the characteristics of Addison County, please see Figure 4 in the attached pages at the end of the report.

#### **Case 4: State of Vermont**

Our application of the rural matrix to Vermont is not a targeted case study in the same way as our town- and county-level matrices, but the rural matrix of Vermont--i.e. the conditions that dictate the successes and challenges of its transportation system-- is still a project finding in itself, and a broader context for our other case studies.

Just as with our town- and county-level case studies, the state-level matrix gets at issues that map onto other rural areas across the country, as informed by our interviews with those involved in national transportation planning and from our research into the field of transportation studies. Aging populations and chronic underemployment, for instance, are perpetual issues in most rural communities. As we learned, though, Vermont faces many more regionally unique challenges, such as the socio-spatial issue of a rising opioid epidemic paired with limited healthcare and rehabilitation facilities. These factors combine to put a considerable strain on Medicaid-funded public transportation. Vermont's topography also poses challenges for reliable transportation in isolated, mountainous, and snow-heavy parts of the state.

These unique issues, in addition to the general challenge of low funding for rural transportation initiatives, make Vermont's rural transportation matrix particularly complex.

Nevertheless, this matrix attempts to outline some of the general factors contributing to Vermont's transportation system, from key stakeholders at the local, regional, and state level, to varying options for governance and communication, to some options and limitations to innovative transportation created by Vermont's conflicting cultural perceptions about transportation. As with our previous case studies, this matrix does not attempt to solve transportation issues outright, but rather to encourage communities and transportation planners to consider the various social, structural factors that determine how transportation works (and how it might be improved) across the state of Vermont.

For our *matrix of rural transportation* filled in according to the characteristics of the state of Vermont, please see Figure 5 in the attached pages at the end of the report.

## Conclusion

The unique characteristics of Vermont influences the manner in which transportation systems can operate, and further, innovate. The rural landscape, pocketed by small urban areas, makes difficult any attempts to increase connectivity. The lack of county government in the state also contributes to the gaps in planning on the state and town level. Our first takeaway, then, is contextual: rural communities across the country will continue to face severe obstacles in maintaining and operating (much less improving) public transportation. This is a combination of chronic under-funding, low populations isolated by unemployment and/or minimal infrastructural development, and minimal critical evaluation of rural transportation systems beyond local and regional planning groups. These circumstances also mean that the transportation issues each community faces are extremely case-specific. The *matrix of rural transportation* can be a useful tool for transportation planners and community members to identify and understand the specificity of issues their transportation system faces before working to devise solutions.

Our analysis also uncovered a visible gap in communication between stakeholders and governance/advocacy members in the state. Transportation issues are being discussed by professionals focused on transportation, and everyday citizens and community members whose day to day activities are impacted by changes to transportation systems are not often represented in these discussions. Another takeaway from this project is that it is crucial not only to advocate for the utilization of a comprehensive transportation framework but also to encourage the inclusion of typically underrepresented stakeholders in the communication and planning processes.

Carrying out this project also allowed us to uncover a potential node of transformation: moments of crisis can become opportunities to reconfigure the system to be more adaptive. This is

clearly evident in reactions to perceptions of scarcity, for example, scarcity of parking. The Greater Middlebury Climate Economy Transportation Task Force responded to Middlebury downtown construction (and the parking issues that came with it) with the idea of introducing a town ‘jitney service’ that utilized parking on the perimeter of town and could be used to transport community members around the downtown area (D. Mammen, personal communication, March 6, 2018). Similarly, the Ludlow model is an example of a town reacting to a crisis (lack of school bus service) and devising an adaptive and innovative solution. Our research has taught us that disruption is often a good opportunity for reworking the current system.

Our final takeaway is comprehensive: the *matrix of rural transportation* is not meant to magically solve transportation issues for rural communities -- rather, it is an attempt to reconcile the inherent difficulties of rural transportation (such as isolation, low population, and minimal industry) with contemporary socio-political issues (such as under-funding, drug crises, healthcare shortages, and school district consolidation). It also attempts to leverage the power and resourcefulness of rural communities to communicate their attitudes, needs, and ideas regarding transportation services and participate in the innovation of rural transportation systems. No system, or framework, is perfect. However, the *matrix of rural transportation* allows community members and transportation planners to engage with their understandings of rural transportation and to engage with one another in the process of making rural transportation systems flexible and capable of adopting more equitable, accessible, and sustainable modes of operation.

### **Future Considerations**

#### **Case Studies:**

An ongoing theme that emerged throughout this project is the unique situation that every individual and town faces in terms of transportation. A transportation model suitable for one town may not suffice for another. Furthermore, this variation may occur temporally as well as spatially;

transportation models may become unsuitable over time or in response to external events, such as Ludlow's imminent threat of school closure due to state-mandated consolidation.

Therefore, the case studies we examined are not demonstrated for use as broad scale replication. Even amongst towns of similar sizes, these transportation options will likely not be suitable; Frank Heald of LMT and Eleni Churchill of VTTrans described Ludlow's locally funded transportation and Richmond's park and rides as "enigmas" due to their unique characteristics for success, respectively. With more time, examining multiple case studies at each scale would allow us to make broader recommendations for the situation-specific transportation models. We believe future work would benefit to include such a comparative study. However, in this current iteration we will draw a rough picture from each case study that may be characteristic of other entities at the given scale.

Ludlow is a "Gold Town" that is very wealthy for its given size. The specific characteristics that allowed this model to exist, as well its limitations, are discussed in our analysis earlier in the report. Still, there are several factors that may be common in similarly-sized towns of around a few thousand individuals. Such towns may be less likely to have private entities that would prevent establishment of public transportation options. This may allow relative freedom to implement public transportation and reshape it to address changing conditions.

Furthermore, small towns will likely have less residential sprawl than larger, more disperse populations. This may allow such a tripper service to occur; the time a student must spend riding the bus is much shorter than larger towns where the bus must make extensive detours. Additionally, the low demand for public transportation in small towns does not interfere with providing students rides.

Finally, such small towns may be nearly inherent centers of innovation. While the wealth of Ludlow allowed for improved route efficiency, the small size of such towns may allow a much more



tailored approach than is possible in larger towns. With such a small population, the town may be able to more easily identify the transportation needs of its citizens, and find it easier to work with fewer stakeholders. While smaller, less connected towns may be more vulnerable to change such as sweeping legislation and financial hardship, their small size may allow unique innovation in times of change.

Richmond is an enigma primarily because of its location. Its close proximity to Burlington and Montpelier guarantees use of a park and ride. Therefore, our case study is truly about the park and ride and its interaction with Richmond's location rather than Richmond itself. Still, this park and ride reveals much about the power (and danger) of location. While the location of a park and ride on a major route of transportation may guarantee its use, it also increases traffic and safety risks. This may be particularly difficult for the nearby communities in regards to increased risk of accidents, increased noise pollution, and construction when building or altering such facilities.

Richmond's subsequent aversion to becoming the "park and ride capital of Vermont" is understandable given the accompanying conditions. The detrimental effects of the park and ride may become heightened if adequate communication does not take place; although we initially referred to this facility as "Richmond's park and ride," the state government built and maintains it. When building such primary facilities with lasting consequences, care must be taken to ensure that communication exists between the different levels of stakeholders. The frequent flooding of the Richmond park and ride and the ineffective alteration of its parking capacity may have been avoided if the local community been engaged earlier in the process and on-going.

Finally, such facilities may actually render multimodal transportation more difficult, particularly if built in unsuitable physical landscapes. The increased traffic may cause cyclists and walkers to feel unsafe. Also, one must evaluate the physical landscape to determine if multimodal transportation is truly possible; the mountainous terrain of Richmond prevents cycling for many

residents. In conclusion, the planning of transportation and particularly static locations such as this park and ride necessitates a holistic approach and the consideration of all factors (geography, safety, etc.). Simply placing a park and ride on a busy highway may ignore the situational variables that reduce its effectiveness.

Within the Addison County case study, adaptability proved to be one of the most successful qualities of ACTR. Addison County's public transportation system proved effective because the manner in which ACTR responded to the demands, feedback, and needs of its customer base incorporated users into the decision-making process and gave these stakeholders a share of decision making power. ACTR reaped the benefits of its adaptation to user needs in the increased ridership that followed such changes.

Currently, ACTR is working through the largest problem it faces now: the constraints placed on capacity by so many users under the DVHA Medicaid contract and the geographic need to utilize paratransit resources. In looking forward, ACTR's ability to adapt to the circumstances it finds itself in (resource and budget strain), along with incorporating user response and demand into its decisions, will likely be useful as ACTR works to address its current dilemma.

Within our examination of the state of Vermont at the largest spatial scale, the occasional conflict of social and environmental sustainability becomes most visible. The capacity difficulties with opioid users seeking healthcare necessitate a responsive paratransit system to meet the baseline health needs of so many of Vermont's residents. While future efforts can hopefully address the underlying causes of drug use in Vermont and surrounding rural areas, in the meantime the state must maintain an equitable and sustainable access to healthcare. Doing so, however, can conflict with and detract from the state's ambitious greenhouse gas emissions reduction goals such as those outlined in its Comprehensive Energy Plan. This kind of intersectionality and conflict is inherent to transportation; the opioid epidemic is one of many striking examples showing that social problems

will often become transportation problems. And since transportation requires the use of resources, fuels, and emissions, transportation is a key part of environmental sustainability.

In the face of these intense difficulties, we have noted that events of disruption and scarcity (i.e. of transportation capacity) can provide the impetus for efficiency and innovation. As ACTR and other rural transit providers work through these challenges, there certainly exist future solutions which balance environmental and social goals depending on values of the communities. Given the promising cases of innovation that we have uncovered across the state, we have hope for those working toward these solutions.

Looking at our research at the state level, it is clear that communication is absolutely essential in accomplishing sustainable transportation solutions that meet the needs of various stakeholders. In a rural state, especially as Vermont lacks county governments, this communication can be strained and difficult. Further, limitations of federal funding mean that Regional Planning Commissions lack many dedicated transportation experts which could work on attending to the needs of so many disparate stakeholders. The spatial connectivity issues of this rural state, and its rural sprawl around certain population centers, only add to these difficulties with communication and coming together. However, looking at cases across the state such as the Richmond park and ride (which would benefit from greater communication between those at state and local levels) and ACTR (whose adaptability relied on clear communication with local users and stakeholders), useful lessons on communication clearly abound. We hope that our case studies here, especially when looked at within a broader state context and within our *matrix of rural transportation*, can help to improve communication between stakeholders.

## Matrix of Rural Transportation

Our *matrix of rural transportation* is ultimately intended to allow citizens of rural communities-- from members of municipal committee and regional organizations to transportation professionals in Vermont-- evaluate the status of their community's transportation system and strategize ways to make transportation more innovative in their area with regards to equity, access, and sustainability. We realize, however, that the strength of this matrix as a tool with which community members can usefully engage will depend as much on the design of the matrix as it will on the content of the framework. The categories and social conditions we identify are by no means mutually exclusive; each one of the categories has relevance to other parts of the matrix, just as each category applies to transportation systems from the local to the state level.

Keeping these things in mind, we would like to attach this section for any community members who use this report to build their own transportation framework. We attempted to limit the number of categories in our matrix so that each category felt important, and we designed the graphic of the matrix itself to convey the web-like network of socio-political and socio-environmental factors contributing to rural transportation. Rather than clutter up the matrix itself with more nuance, we decided to separate out each category into a set of three questions, each meant to engage community members in critical thinking about transportation. We based the structure of our questions off of the 2013 Resilient Communities Scorecard produced by the VNRC; we would hope that community members could engage with our questions about rural transportation in manner similar to how the Resilient Communities Scorecard asks users to rank the level of participation or engagement with a certain aspect of the community.

At the moment, the condensed, applicable summation of our project lives in the form of our *matrix of rural transportation* (see Figure 1) and the accompanying set of questions about each condition of success (see Appendix). Ideally, this format could be developed further to better engage

users (i.e. community members, organization leaders, and transportation planners) in strategizing innovative transportation systems. This is more a matter of the psychology of user-oriented frameworks and designing effective materials, but it could contribute to changing the way communities approach making changes to their transportation systems and allow communities to visualize innovative methods of transportation in rural areas.

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## Appendix: Matrix Category Questions

### **Stakeholders**

- (1) Who are the key stakeholders (i.e. funders, users, operators, providers, riders/markets, employers, health services) determining the transportation system? Who participates in the decision-making process of operating, evaluating, and improving community transportation?
- (2) Who monitors and evaluates the transportation system and how?
- (3) What options do stakeholders have to advocate change in transportation management? In particular, how might less powerful actors (i.e. those who have minimal access to transportation and limited representation in transportation planning) get involved?

### **Governance**

- (1) What policies and governing bodies control or hold decision-making authority (capacity to implement policy, systems, etc.) over the transportation system?
- (2) Which stakeholders hold more authority or representation in the decision-making process? Who decides what changes are made to the transportation system?
- (3) What is the process of making changes to the transportation system? On what time-scales do transportation projects operate? How are changes implemented, and by whom?

### **Communication**

- (1) How often are community stakeholders and governing bodies in communication and coordination with one another? What avenues currently allow this interaction?
- (2) What might limit communication between decision-makers and advocates for changes to transportation? What opportunities are there for community oversight and input on transportation policy?
- (3) Which organizations, key figures, and other avenues of communication allow stakeholders to get more representation and input in transportation management?

### **Funding**

- (1) What are the sources of funding for public transportation? How does funding break down from public (federal → state → local) users to private, such as philanthropic organizations and individuals?
- (2) How do funding requirements limit and/or enable transportation initiatives (ADA, Medicaid, etc)? Does funding address demand-side factors (fares, reduced and free rides, capacity limits and route performance) as well as supply-side factors (bus fleets, support staff and drivers, routine vehicle maintenance)? What mechanisms are in place for funding, including but not limited to funding silos?
- (3) What allows for changes in established funding protocols? How much are funding allocations subject to public review and input, and how can rural communities tap into existing transportation grant programs?

### **Legislation**

- (1) What existing legislation dictates how the transportation system operates (funding allocation, service requirements, etc.)?
- (2) Does legislation enhance or restrict the ability of key organizations to collaborate and communicate?
- (3) How have shifts in legislation changed the way transportation operates in the community (Act 60, restructuring of Medicaid contracts)? Are there anticipated shifts in major realms of transportation, such as the Vermont Education Consolidation Act? What opportunities are there to partake in this legislative process and influence the outcome?

### **Infrastructure**

- (1) What infrastructure currently exists for transportation use in the community (bus stops, transit hubs, Park & Rides, shuttle services, highways)?
- (2) How is this infrastructure incorporated into the physical landscape surrounding the community? (valley, mountainous, presence of village/compact area, spread out housing, etc). Consider land use practices and development and construction projects as well.
- (3) How are changes to this infrastructure implemented, and what is the process of changing transportation infrastructure in the community? Is there a central entity that coordinates infrastructure changes for holistic planning?

### **Connectivity & Mobility**

- (1) Where are key services located (education, health centers, grocery stores, key employers)?
- (2) How do community members get to these key areas? Which methods of transportation are easiest and used most? How would you characterize the land use patterns of the community?
- (3) Is there potential to improve transportation efficiency (i.e. through carpooling, streamlined routes, transit hubs) throughout the community, and who in the community would benefit most from these changes?

### **Distribution of Access**

- (1) How does transportation factor into the community economy? How much do community members rely on public transportation for access to goods (groceries, shopping and restaurants) and services (healthcare, education, places of employment)?
- (2) How is wealth distributed throughout the community? How does individual and community socioeconomic status factor into transportation decisions?
- (3) What might allow all members of the community similar access to transportation and key services? How can transportation options account for financial and cultural barriers in the community?



## **Culture & Perceptions**

- (1) What is the composition of user types for this transportation system? How many users choose their mode of transportation, and how many community members are reliant on certain transportation options?
- (2) What are the predominant attitudes toward transportation in the community? Is there support or demand for public services, an interest in efficiency/sustainability, etc? How might this affect the economic success and sustainability of the transportation system.
- (3) How might the transportation system adapt to shifts in local demographics (age, occupation, gender, wealth) and changes in attitudes toward transportation?